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**IN CROP WEED CLIPPING FOR ORGANIC WEED
CONTROL**

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Final Report

**In Crop Weed Clipping
for Organic Weed Control**

by

Marysburg Chapter OCIA and PAMI



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Table of Contents

	Page
1. Summary	1
2. Background and Objectives	2
3. Project Description	3
4. Results and Discussion	11
4.1 Machinery Performance	11
4.2 Effectiveness of Weed Removal	18
4.3 Scott Project	32
5. Conclusions	35

Acknowledgement

PAMI wishes to acknowledge the funding support provided by The Agriculture Development Fund of the Saskatchewan Department of Agriculture and Food.

1. Summary

The organic weed-clipping project was initiated in the Marysburg, Assiniboia, and Scott areas in summer 1999. The two main objectives of the project were to modify a self-propelled swather to clip weed flowers and seeds above the crop canopy of poorly competitive crops to determine the effects of weed clipping on crop yield and subsequent weed populations.

A Massey model 200, 34 ft (10.4 m) wide, self-propelled swather was successfully modified to remove weeds above the lentil crop canopy. A custom built clipper using flails was also successful in removing weeds above the crop canopy.

An error occurred in the program sequence, as yields were not taken as planned at the Marysburg and Assiniboia sites in Fall 1999. The project was modified and extended one year to correct the deficiency. Five new sites were selected in the Spalding area in Spring 2000, with a check and clipped treatment at each site. Weed clipping was very effective in removing seed heads and flowers above the lentil crop canopy. In Fall 2000, clipped treatments had higher grain yields than the check in two of four harvested sites. Weed counts in the following crop (2001) indicted a dramatic reduction in weed count numbers in three of four sites. In Spring 2002, cold spring temperatures prevented effective mechanical weed control resulting in very high weed counts. Severe drought conditions throughout the 2002 year resulted in near crop failure at all four sites.

The weed science part of the project was conducted at the Scott Research farm in 1999/2000 and 2000/2001. Clipping had no effect on the lentil yield in either year. In the 1999/2000 study the carry over effect of clipping resulted in reduced wild oat counts and in the 2000/2001 study the carry over effect of weed clipping resulted in reduced wild mustard and lambs quarters counts.

2. Background and Objectives

Organic farmers need an additional means of controlling weeds, especially in poorly competitive crops. Cutting off the heads of weeds above the crop canopy prior to weed seed viability may reduce the viable weed population in the seed bank resulting in cleaner, higher yielding crops. Some initial farmer experimentation indicates that removal of weed seed heads will reduce future weed populations and may increase yield. Measurements of the short term and long term effects of removal of weed seed heads need to be taken to assess the effectiveness of the machinery and its effect on weed populations and crop yield. If clipping is successful, it may also be attractive to conventional producers of low competitive crops (pulses, flax, etc.), if costs are lower than chemical control methods, or when herbicides are not available due to lack of registration.

The objectives of the project are:

1. To assess the effectiveness and improve the performance of two types of weed head clippers.
2. To reduce weed seed build-up in the soil by the clipping of weed seed heads above the crop canopy.
3. To measure the effect of clipping weed seed heads on weed population and crop yield.
4. To determine the optimum clipping time to reduce weed seed production (AAFC Scott).

3. Project Description

Three methods of clipping weed seeds were assessed for their effectiveness in clipping weed seed heads above the crop canopy of poorly competitive crops in 1999. In 2000, the project was modified with the dropping of the 1999 sites and inclusion of five new sites in the Spalding area. In addition, a scientific weed clipping study by Agriculture and Agri-Food Canada at Scott, Saskatchewan was carried out in 1999/2000 and 2000/2001.

The three weed clipping systems assessed in 1999 include:

1. A modified self-propelled swather.
2. A standard swather with canvas removed.
3. A prototype flail chain system developed by Crestview Organic Farms at Assiniboia.

A 34 ft (10.4 m) wide, Massey 200 self-propelled swather was modified to prevent hang up of cut weed material on the cutterbar and swather table. With the exception of a modified canvas system (**Figure 1**), all other modifications were set up with the canvases removed to prevent windrowing of the cut weed material. Modifications included the following: canvas removal, table backboard and draper frame removal, deflectors on knives, deflectors above table, and the addition of flexible PVC belting to the reels to assist in movement of green weed material off the knife (**Figures 2 to 8**).

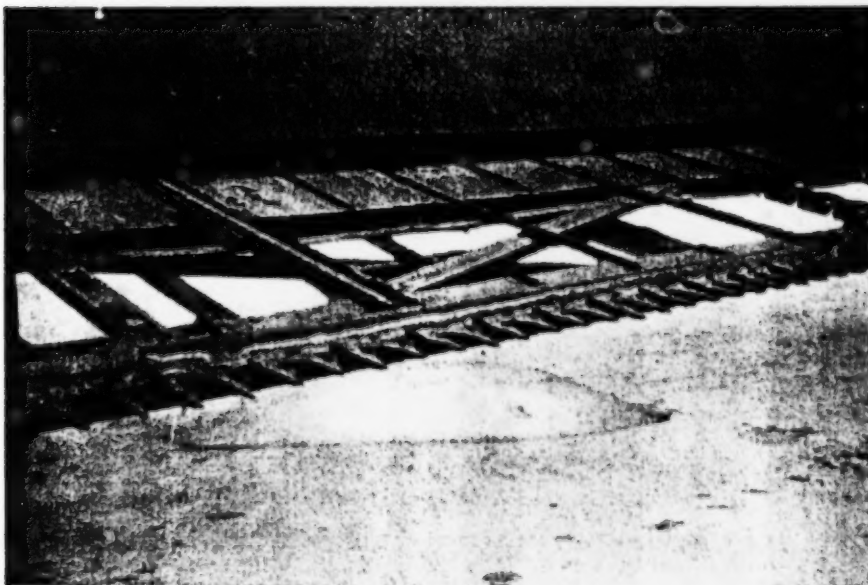


Figure 1. Swather with Modified Canvas.



Figure 2. Swather with Canvases and Canvas Supports Removed.



Figure 3. Knife Deflector.

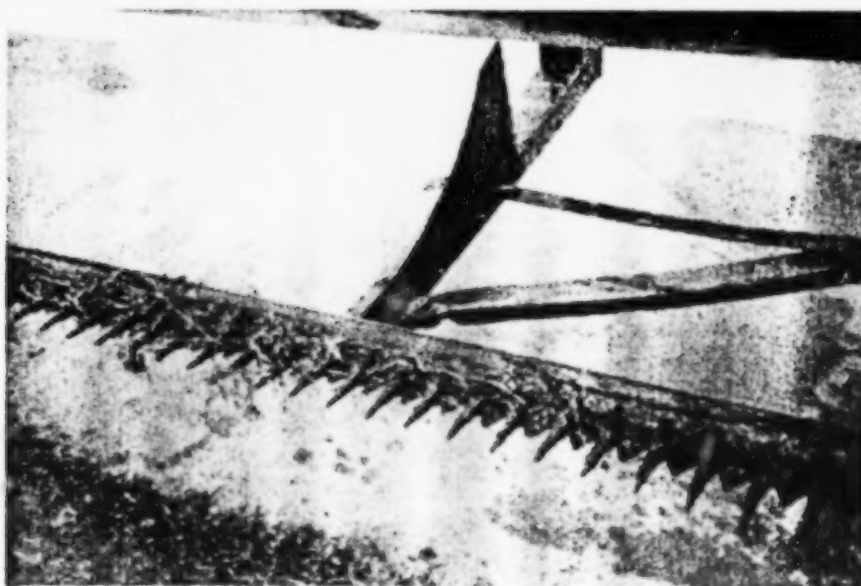


Figure 4. Half Moon Deflector.

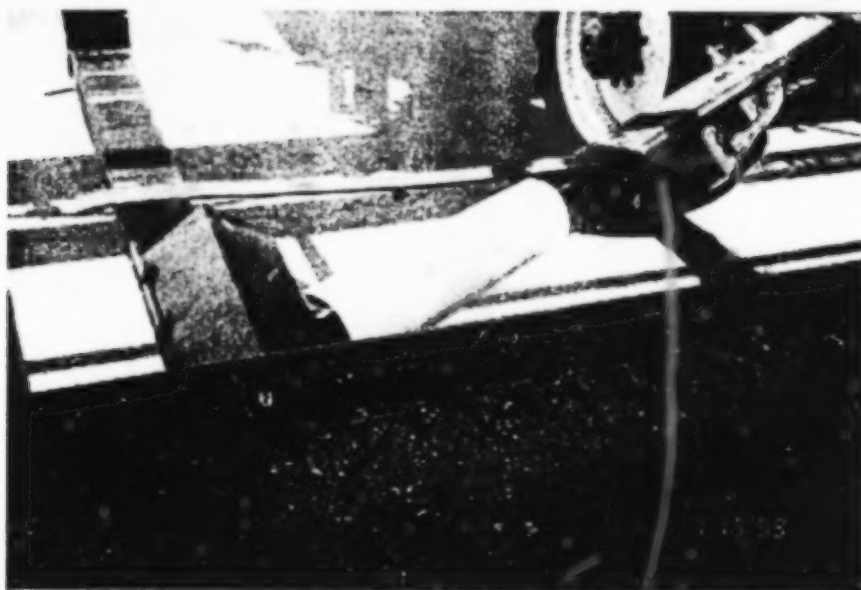


Figure 5. Half Round and V-Deflectors.



Figure 6. Half Round Deflectors with Cross Brace Repositioned Away from the Front of the Table.

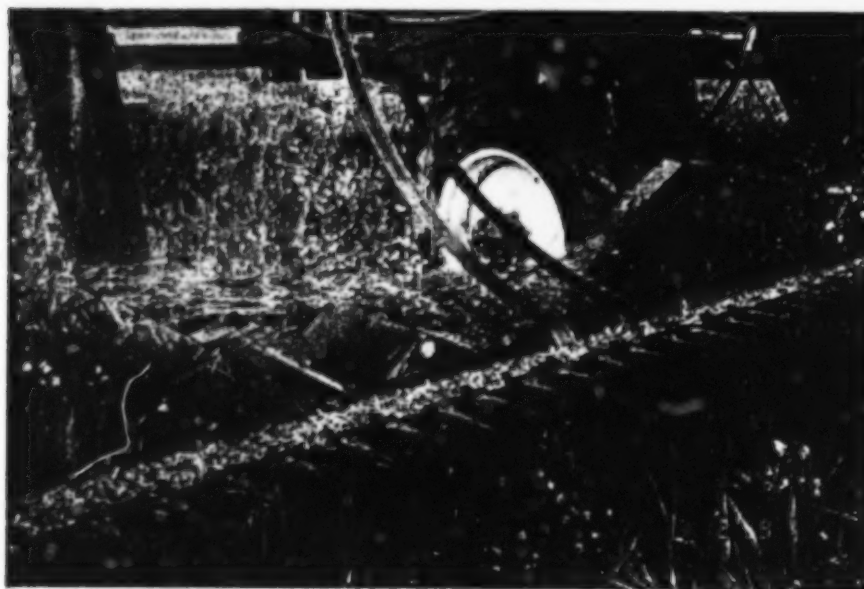


Figure 7. Deflectors.

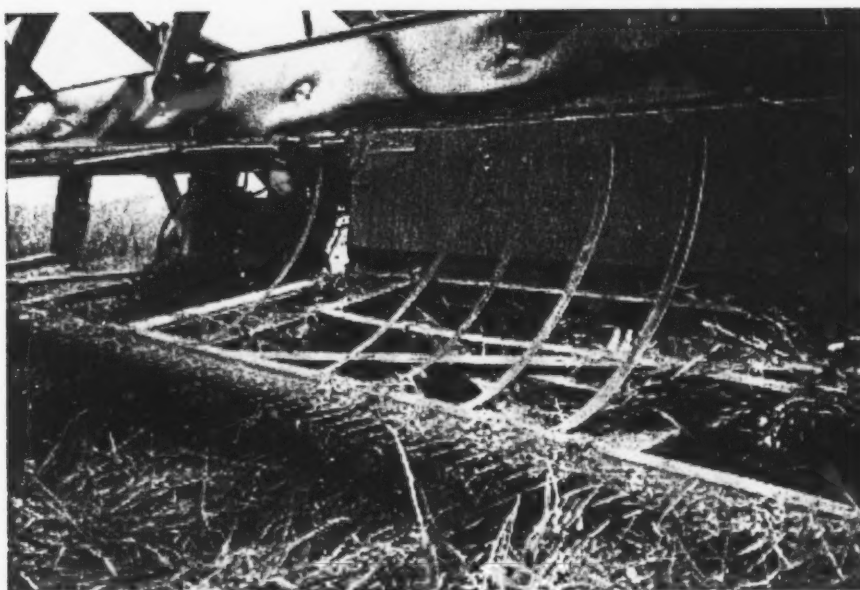


Figure 8. Multiple Defectors and Flexible PVC Strip on Reel Bats.

The flail system consists of a 22 ft (6.7 m) wide series of flail chains that replaces the table on a CI 550 self-propelled swather (**Figures 9 and 10**).



Figure 9. CI Swather with Shredder.

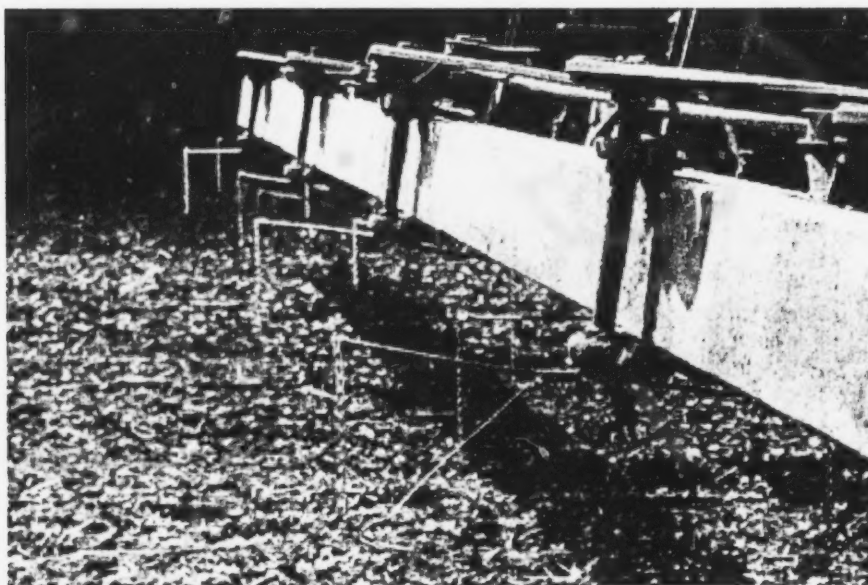


Figure 10. Shredder Showing the Flail System.

All systems were operated just above the crop canopy and the cutterbar or flails cut or shred the heads of tall weeds. The operation is timed so the weeds are cut quickly after elongating above the crop canopy to minimize viable weed seeds.

Three organic fields in the Humboldt area and one field in the Assiniboia area were selected for the project. The fields were in organic production and were seeded to lentil in 1999. The three fields in the Humboldt area had one part of each field split into four sections including one part cut with standard swather with canvas removed, one part with the modified swather, one part with the flail system, and one part an unclipped check. In the Assiniboia field, a swather width check strip was left beside the flailed treatment. The farmer cooperator judged clipping timing when the weed growth above the crop canopy was at maximum without the weed heads setting viable seeds. Following clipping of the fields, the effectiveness of the clipping system was determined by m^2 seed head counts in the treated and check areas. The counts include the number and type of weeds left standing above the crop canopy. Twelve parallel m^2 counts were taken in the treated and check areas. Total m^2 counts were 48 per field except for Assiniboia where there were 24 m^2 counts. The location of each m^2 was permanently identified using a buried pin and rope system.

As yields were not taken in Year 1, the project was extended to four years, with the following changes:

1. Discontinuation of all work on the 1999 plots at Marysburg (three sites) and Assiniboia (one site).
2. Renting of the same or a similar swather as 1999, for following years, modified to effectively clip weeds above the crop canopy.
3. Selecting five new organic sites for Spring 2000 that would be seeded to poorly competitive crops, such as lentil or flax.
4. At each site, there would be two treatments – a clipped treatment and an untreated check.
5. Following clipping and two weeks later, 12 x 1 m² weed head counts to be taken from each strip.
6. Yield and dockage was taken from each site.
7. Continuation of weed counts, seed yield, and dockage at all sites in 2001 and 2002.

Other methodology for the revised project is similar to the original project.

In Year 3 and 4 (2001 and 2002), the new organic fields were seeded to more competitive crops and were not reclipped. The original m² areas were identified and weed counts were taken to determine changes in weed population due to clipping in Year 2. Seed yield and dockage were sampled in all treated and check areas for the four years of the study to determine yield effects of clipping.

At the end of Year 4, the data was analyzed to assess the effectiveness of the machinery in clipping weed seed heads on weed population and crop yield.

In 1999, the Marysburg chapter of OCIA, in cooperation with PAMI, did the Humboldt area field operations with the stubble cutter and chain flail, while Crestview Farms operated the chain flail at Assiniboia. In 2000, Marysburg OCIA members cooperated with the five new sites in the Spalding area. In 2000, the check strips in one of the sites was destroyed, so this site was lost from the study. In both years, PAMI worked with the farmer cooperators in field selection and location of the test strips. Square metre weed counts, grain yield, and report writing were completed by PAMI.

The Scott Research farm conducted small plot scientific experiments to determine the effect of timing of weed clipping on weed competition and seed production. The following is the test protocol for the experiment at the Scott site.

The experiment was conducted in 1999-2000 and 2000-2001 growing seasons. Previous crop was wheat stubble and summerfallow for the 1999-2000 and 2000-2001 experiments respectively. Experimental design was a randomized complete block with four replications. In both years, CDC Glamis lentil was seeded in 9 in (22 cm) rows at a seeding rate of 116 lb/ac (130 kg/ha) on May 18, 1999 and May 8, 2000. Wild oat and wild mustard were seeded between the crop rows at a density of 100 seeds/m² for each species. Clipping was conducted with a gas powered hedge trimmer at the following timings:

- Wild mustard in full flower/wild oat in boot stage.
- Wild mustard podded, wild oat head
- Wild mustard seed mature, wild oat at mid-dough stage

A broadleaf and grass herbicide treatment and an unclipped weedy check were also included. Data collection included crop yield and wild mustard and wild oat seedling emergence the following spring (plants/m²) prior to seeding. In the spring of 2001, lambs quarters emergence was also recorded.

The methodology for the 2001, 2002 years at Spalding included seeding by the farmer, co-operator to a competitive crop of the previously established plot areas identified by PAMI in 2001. Site #1 was seeded to 6 row barley and sites #2, #3, and #5 were seeded to oat. Site #4 was lost due to accidental clipping of the check strip by the cooperator in 2000. Weed counts in 2001 were taken on May 11 at 12 locations in each treatment located (0, 10, 22, 36, 52, 70, 90, 112, 136, 162, 180, and 200 feet) from the front of each treatment strip. Each area counted was 6/9 of a m² with the counts adjusted to seeds/m².

In 2002, Sites #1, #2, and #3 were seeded to hard red spring wheat, while site #5 was seeded to French green lentil. Weed counts were taken on May 18 and June 21, 2002.

A Hege small plot combine with a 4 ft (1.2 m) straight cut header was used for harvesting a single 200 ft (60.9 m) strip up the centre of each treatment. An exception was at Site #2 where only 194 ft (59.1 m) was cut due to tramping at one end of the plot. (There was difficulty in locating the plot pin that lead to excess foot traffic.) The crop samples were later weighed and cleaned to determine yield and dockage.

4. Results and Discussion

The project was initiated in the Marysburg, Assiniboia, and Scott areas in 1999. A 34 ft (10.4 m) Massey 200 self-propelled swather was rented for the project and many modifications were made to optimize the weed cutting for the field studies. Three lentil fields in the Marysburg area were selected for the project. A flax field would have been used at Marysburg, however the high precipitation in the summer of 1999 resulted in unusually tall flax plants. The average height of the flax field was so high that the swathers and flail system were not able to raise their tables high enough to clear the top of the flax crop. The crop height problem would not likely have occurred in most years, so it would not usually limit the use of modified swathers for weed clipping, but if needed additional height could be incorporated into future swather modifications.

Five organic lentil fields in the Spalding area were selected in Spring 2000 for the revised project. Site #4 was removed from the test due to inadvertent clipping of the check by the co-operator in 2000.

4.1 Machinery Performance

The efficiency of cutting the above canopy weeds with the Massey 200 swather depended on the cutterbar performance and how well the cut weed material clears the knife and the swather frame structure.

4.1.1 Cutterbar

The knife was very effective in cutting the above canopy weed material. However, short sections of wet material hung up on the back part of the cutterbar and were not swept away from the knife by the reels. Plastic pickup teeth attached to the reel bats were not effective in removing the built up weed material (**Figure 11**).

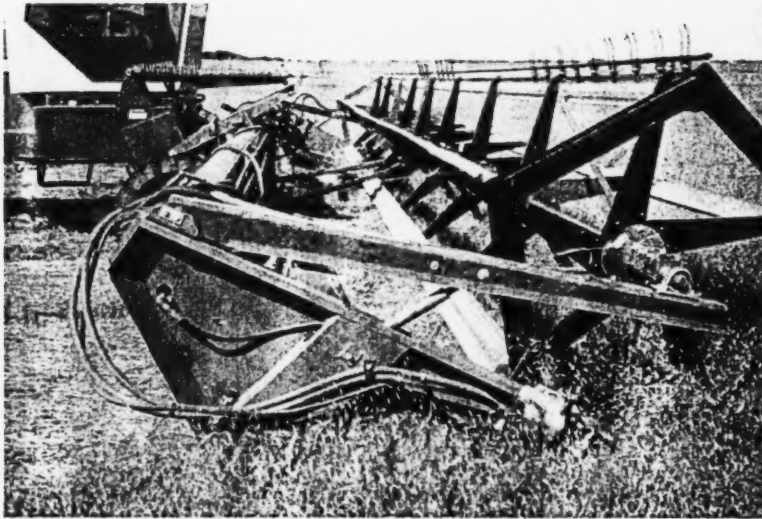


Figure 11. Swather Reel with Plastic Pickup Teeth on Bats.

A second potential solution to the cutterbar clearing problem was the attachment of PVC belting to the reel bats with the belting extended approximately 3" (7.5 cm) below the edge of the bats. The PCV belting was very effective in sweeping the cutterbar as the belting was stiff enough to sweep the cutterbar but flexible enough to bend when in contact with the guards (**Figure 12**).



Figure 12. PVC Belting on Reel bats Effectively Cleaning the Cutterbar.

Minimum reel height was adjusted to allow the PVC belting to sweep the cutterbar. However, a problem was encountered with this modification as the additional weight of the belting created flexing problems with the reel as discussed in section 4.1.3. The reel-flexing problem was unique to this swather model and wide header width combination and would not likely be a problem with most commercial swathers.

4.1.2 Material Flow After Cutting

After the weeds were cut, the material needed to fall to the crop below, spread out over the full cut width of the swather to prevent bunching or flattening of the crop. Removal of the canvas was not successful as the cut material hung up in the canvas support system (**Figure 13**).

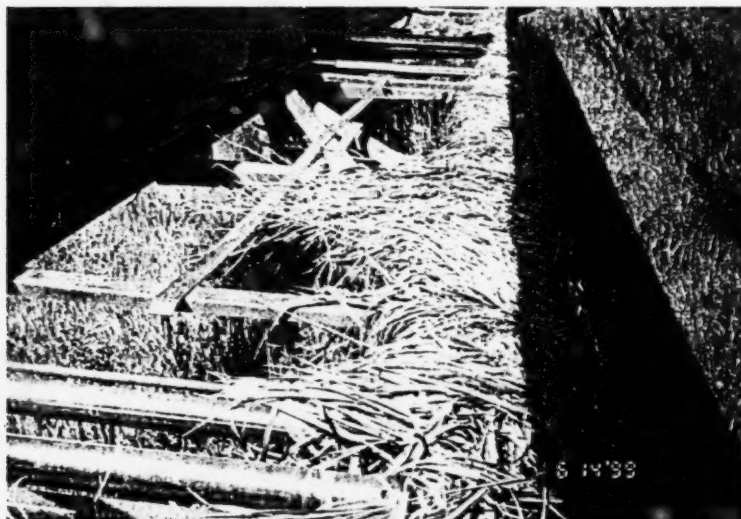


Figure 13. Weed Material Hung up in the Canvas Support System.

To address the weed hang up problem, a number of modifications were made to the swather. The canvas was modified by cutting out the lower (close to cutterbar) 2/3 of the canvas and removal of every second slat (**Figure 14**).

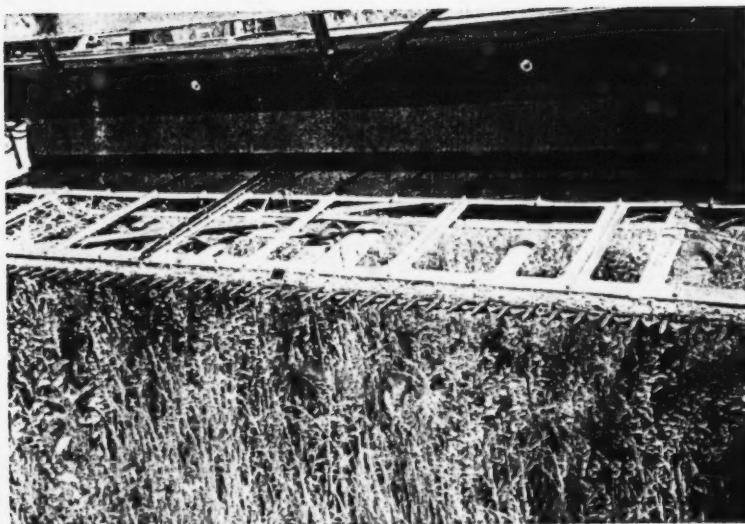


Figure 14. Modified Canvas.

The remaining slats were effective in sweeping the cut material from the frame structure and on to the ground. However, this modification was abandoned as weed material built up on the canvas rollers causing the canvas to jam.

The next series of modifications included removing the canvases, canvas support structure, and rollers to prevent weed buildup on the header frame. Removal of those components resulted in improvement of weed flow but material built up where the diagonal brace and the front to rear brace met behind the cutterbar. Metal deflectors and canvas shields were mounted on the braces but were not successful in preventing weed buildup (**Figure 15**).

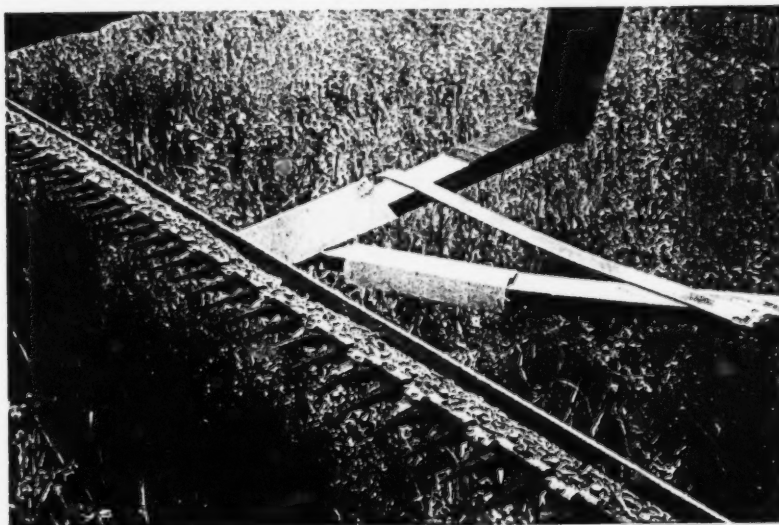


Figure 15. Metal and Canvas Shields.

The following two diagrams (**figure 16 and 17**) illustrate the total revisions to the swather to remove structural components, which interfered with natural flow.

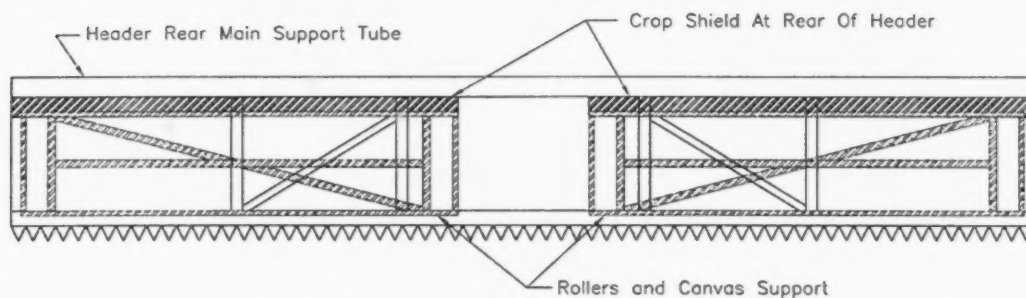


Figure 16. Unmodified Swather Frame.

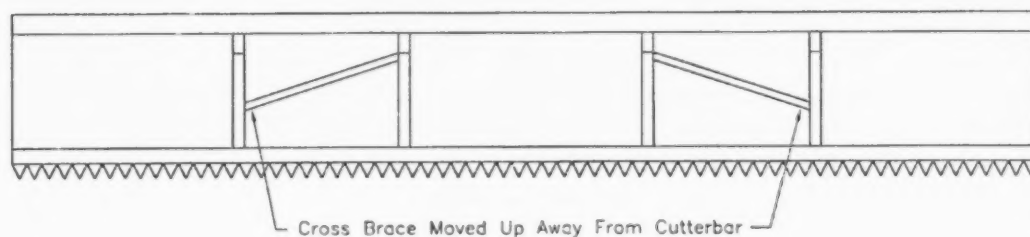


Figure 17. Modified Swather Frame.

The diagonal brace was removed and replaced 20" (50 cm) away from the cutterbar and the front to rear braces covered with half of an 8" (20 cm) diameter PVC water pipe (Figure 18).

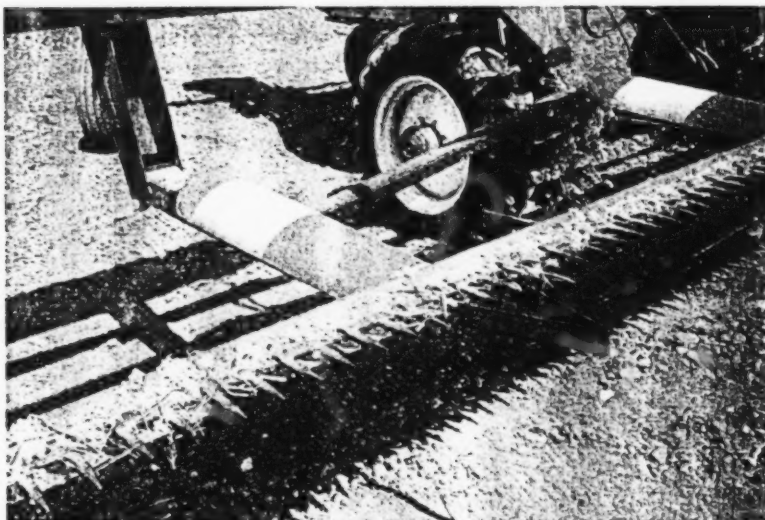


Figure 18. Brace Modification and PVC Deflector.

The half pipes were effective in preventing most green weed material from building up on the braces (Figure 19).

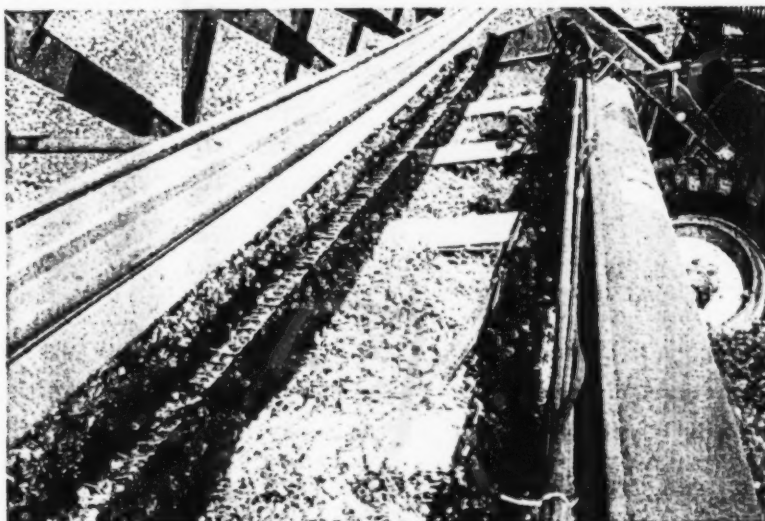


Figure 19. Successful Weed Flow over PVC Deflector.

Weed buildup occurred over time, at the rear of the covered diagonal braces but it would normally self clean after reaching a minimum volume of material.

4.1.3 Additional Swather Modifications

A header-flexing problem occurred with the Massey swather when operating on rough terrain. The header was supported by a 10 inch (25 cm) diameter pipe supported at the center of the swather. In rough terrain the ends of the pipe flexed down and lowered the attached reel. At the same time, the reel flexed downward in the middle because it was supported at the outer ends of the header. Part of the cause of the excess flexing was due to the extra weight of the belting on the reel bats. The combination of header frame and reel flexing resulted in contact from the reel bats with the cutter bar resulted in damage to the reel (Figure 20).

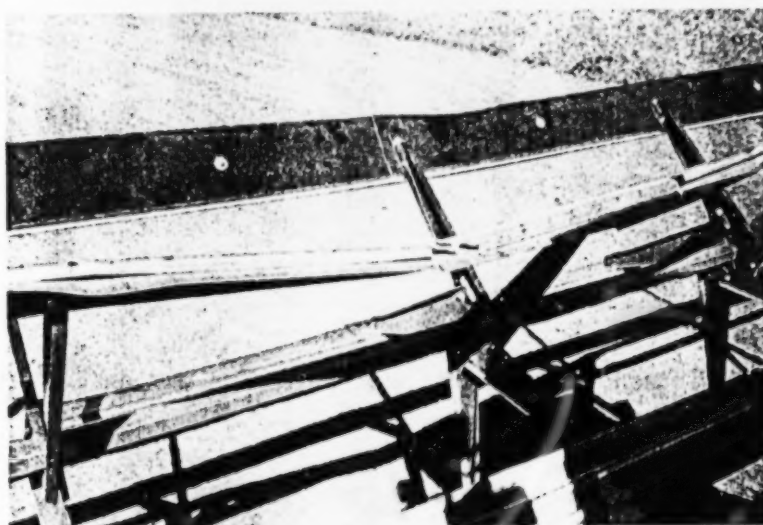


Figure 20. Reel Damage from Contact with Cutterbar.

To solve the flexing problem both the header pipe and reel were reinforced with additional bracing. It should be noted that the swather used for this project had an under designed header frame and reel. This problem will not likely occur with most self-propelled swathers.

One other modification to improve swather weed clipping performance was the addition of a needle valve in the header hydraulics. The needle valve dampened the speed of raising and lowering the header to ease the adjustment of optimum weed clipping height.

One of the problems with clipping weeds above the crop canopy is damage to the crop from the wheels of the swather. As wide swathers usually have wide drive tires, it was decided to replace the standard flotation tires with narrow wheels and tires. The standard wheels and tires were about 20" (50 cm) wide (21.5L - 16) and the replacement tires about 9.5" (24 cm) wide (11.2 - 24). As the narrow rear wheels and tires followed in the tracks of the front drive wheels this change resulted in a reduction in crop tramping from 4.9 to 2.3% of the total crop.

4.2 Effectiveness of Weed Removal

4.2.1 Year 1 - 1999

Each of the clipped fields was rated for effectiveness of the weed clipping by counting the number of weed heads and flowers above the crop canopy (**Figure 21**). Field 1, a French green lentil field at Marysburg, was severely infested with wild mustard. Weed clipping was highly effective with over 87% of seed heads and flowers removed with the three clipping systems (**Figure 22**).

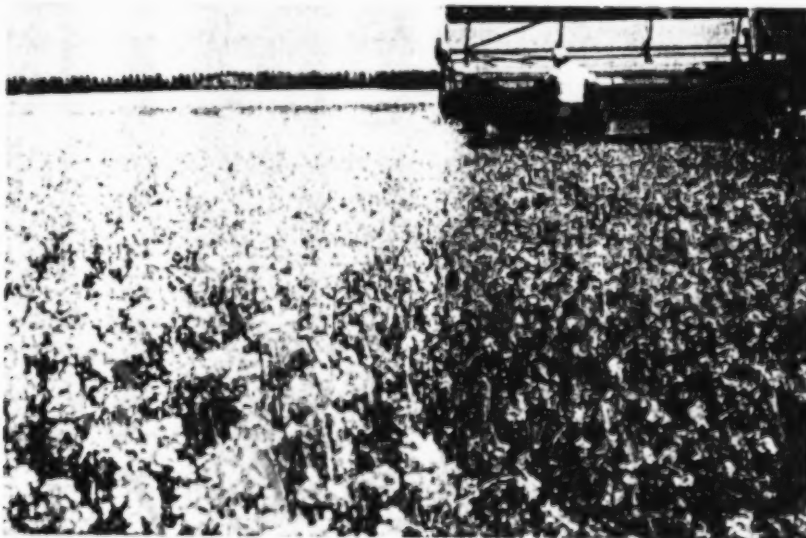


Figure 21. Effective Weed Clipping.

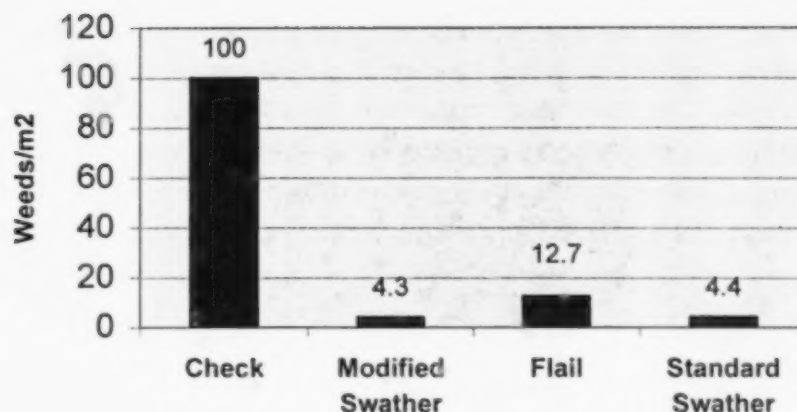


Figure 22. Marysburg Field 1 – Weeds/m² Following Clipping.

The flail system was not as effective as the modified swather at Site #1 because the system was not designed to operate in the tall crop conditions that occurred in the summer of 1999. As the flail system was raised above the tall crop canopy, the flails operated at an angle rather than perpendicular to the crop. This resulted in missing of weeds.

Field 2, a French green lentil field at Marysburg, was not as weedy as Field 1 and there was a roughly equal infestation of wild mustard, wild oat and lambs quarters in this field. Weed clipping was effective in reducing weed seed heads and flower heads to less than 1 weed/m² with the modified and standard swather. In contrast the flail was not as effective at weed cutting due to the height of the lentil crop (**Figure 23**).

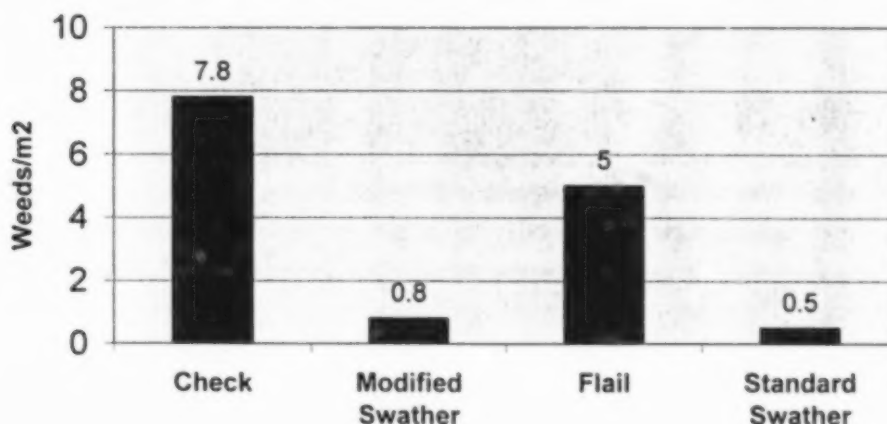


Figure 23. Marysburg Field 2 – Weeds/m² Following Clipping.

Field 3, a Laird lentil field at Marysburg, was not as weedy as Field 1 with almost no wild mustard and about 15 wild oats/m². The wild oat panicles were not extended very far above the lentil canopy resulting in relatively poor clipping efficiency (**Figure 24**).

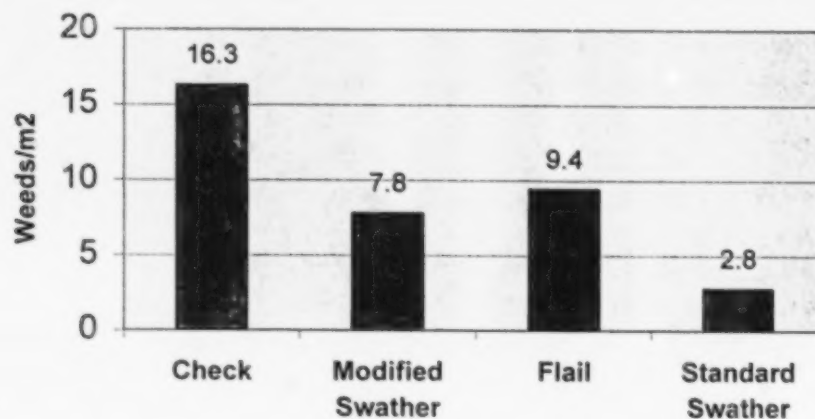


Figure 24. Marysburg Field 3 – Weeds/m² Following Clipping.

Weed clipping with the flail system at Assiniboia was highly effective with a 99% reduction in weed heads and flowers above the lentil canopy (**Figure 25**).

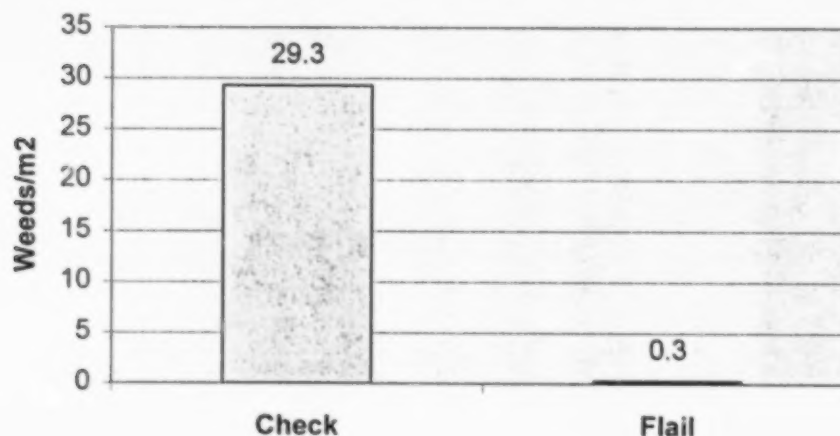


Figure 25. Assiniboia– Weeds/m² Following Clipping.

In summary in 1999, all three clipping systems were effective in removing seed heads and flowers above the crop canopy and the higher the weed infestation the more effective the clipping was in reducing above canopy weed population.

4.2.2 Year 2 - 2000

Each of the clipped fields and check strips were rated for effectiveness of weed clipping by counting the number of weed heads and flowers above the crop canopy. In contrast to 1999 where wild mustard was the predominant weed, in 2000 wild oat was predominant with low wild mustard infestation. In the unclipped checks, over 87% of weeds above the crop canopy were wild oat (Figures 26, 27, 28, 29, and 30).

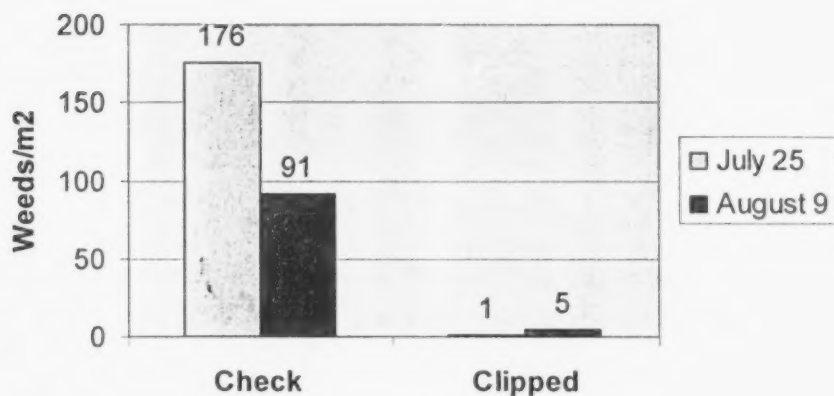


Figure 26. Spalding Field 1 – Weeds/m².

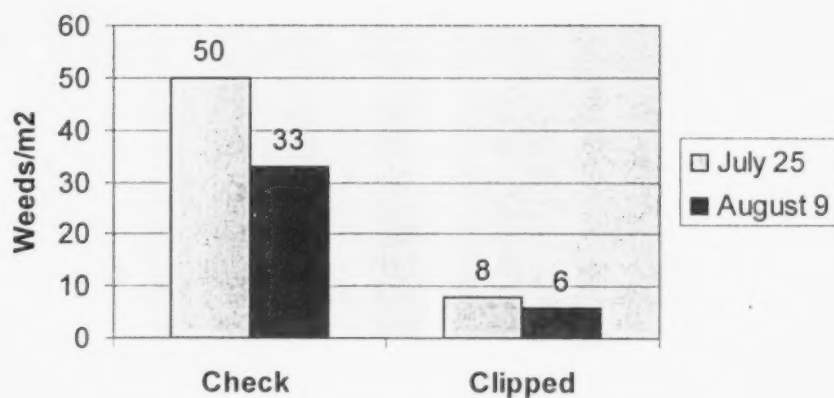


Figure 27. Spalding Field 2 – Weeds/m².

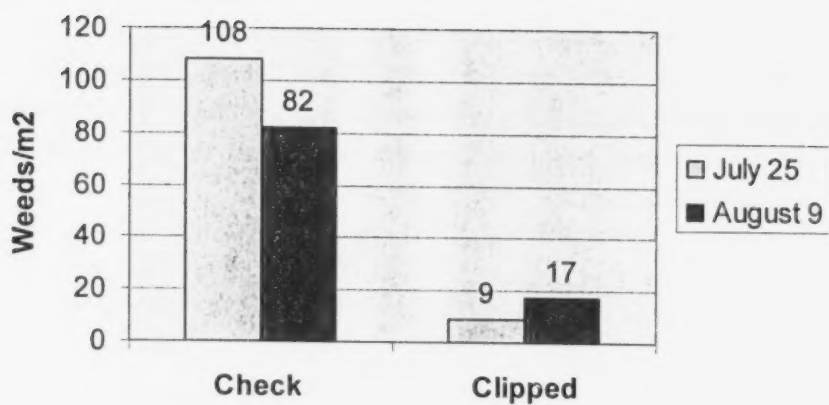


Figure 28. Spalding Field 3 – Weeds/m².

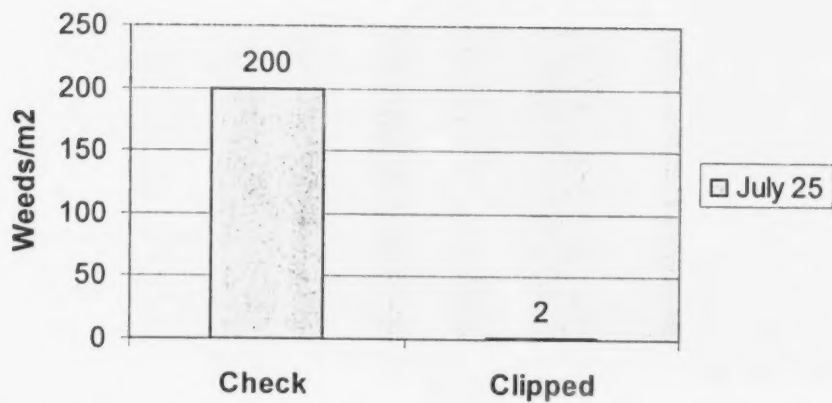


Figure 29. Spalding Field 4 – Weeds/m².

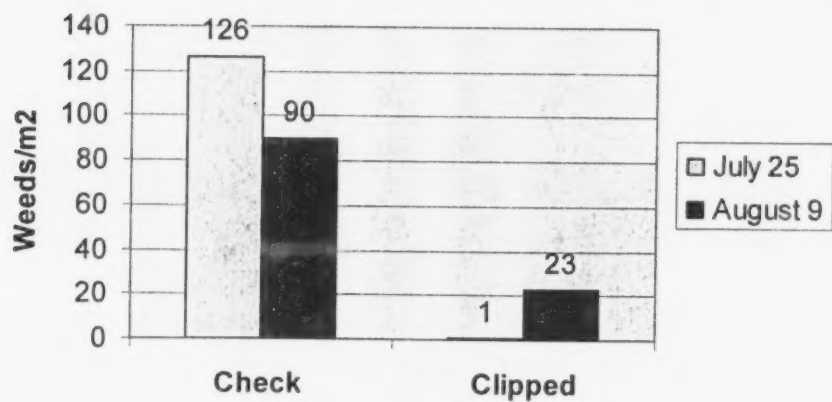


Figure 30. Spalding Field 5 – Weeds/m².

Field 4 was lost following inadvertent clipping of the check area by the co-operator while clipping the whole field. Similar to 1999, weed clipping was very effective in reducing weed seed heads and flowers above the crop canopy with an average reduction from 132 weeds/m² in the check to an average of 4 weeds/m² with the clipped treatments (July 25 weed count). A second weed count 15 days after the first count resulted in lower weed counts for the check and a small increase in weed count for the clipped treatments at three of four sites. The small increase in weeds/m² 15 days after clipping is an indication that weed clipping was effective in reducing the above canopy weed population over an extended period.

It was anticipated that weed clipping would not affect yield in the year of clipping as yield losses mainly occur due to competition at early stages of crop development. However, the clipped treatments had higher lentil yields compared to the check at two of four sites (**Figures 31, 32, 33, and 34**).

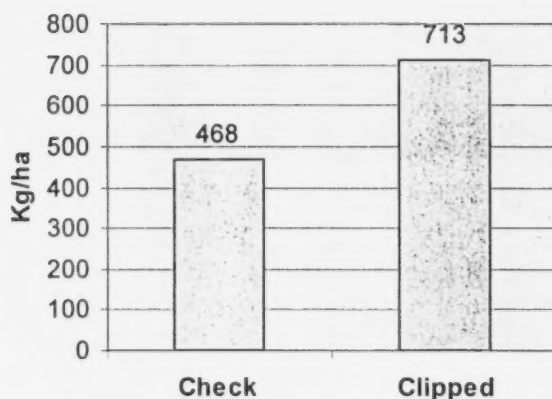


Figure 31. Spalding Field 1 – Lentil Seed Yield.

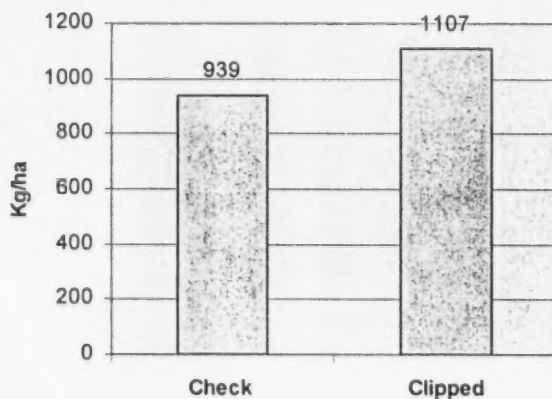


Figure 32. Spalding Field 2 – Lentil Seed Yield.

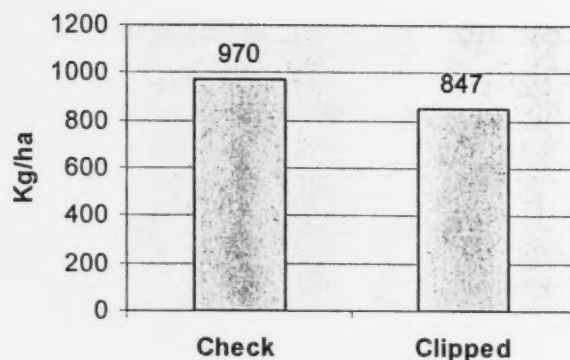


Figure 33. Spalding Field 3 – Lentil Seed Yield.

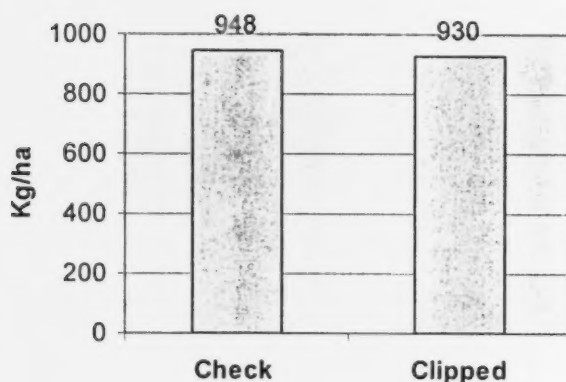


Figure 34. Spalding Field 5 – Lentil Seed Yield.

When the data from the four harvested sites were combined, the clipped treatments averaged 7.6% higher seed yield compared to the unclipped check. Differences in yield at individual sites ranged from an increase in yield due to clipping of 53.4% in Field 1 to -12% in Field 3.

4.2.3 2001 Results – Spalding Plots

Low rainfall caused poor yields in all plots. Weed counts were taken May 11, 2001 and indicated much lower weed populations in the clipped treatments compared to the unclipped checks at three of four test sites. At Site #2 (Figure 36), both the unclipped check and clipped treatments had relatively low weed populations. At the three sites (Figures 35, 37, and 38), where there were heavy weed population in the check, the number of weeds in the check area average almost four times the weeds in the clipped treatments.

Grain yield was higher for the clipped treatments at two of four sites (**Table 1**). Grain yield for the check treatment was higher than the clipped treatment at Site #3. Grain yield was the same for both treatments at Site #2. At Site #5, the oat yield of the clipped treatment was double that of the unclipped check. A reason for this dramatic response is not readily apparent. (Data was checked to ensure that it is not due to an error in sampling or recording data.) In general, drought stress in 2001 was a major factor in low grain yields.

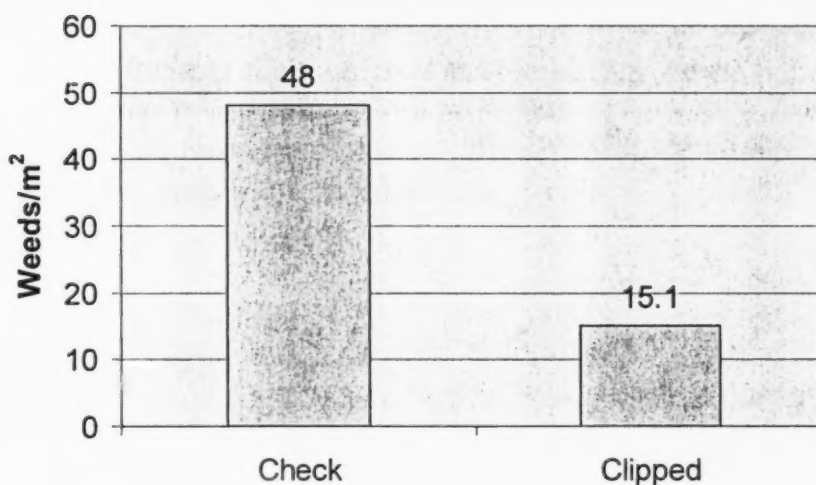


Figure 35. Effect of Weed Clipping on Weed Population 2001 – Site #1.

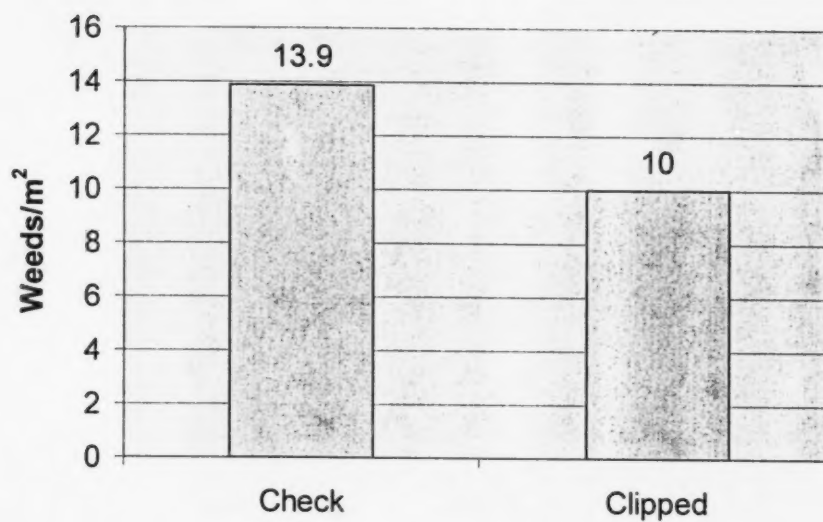


Figure 36. Effect of Weed Clipping on Weed Population 2001 – Site #2.

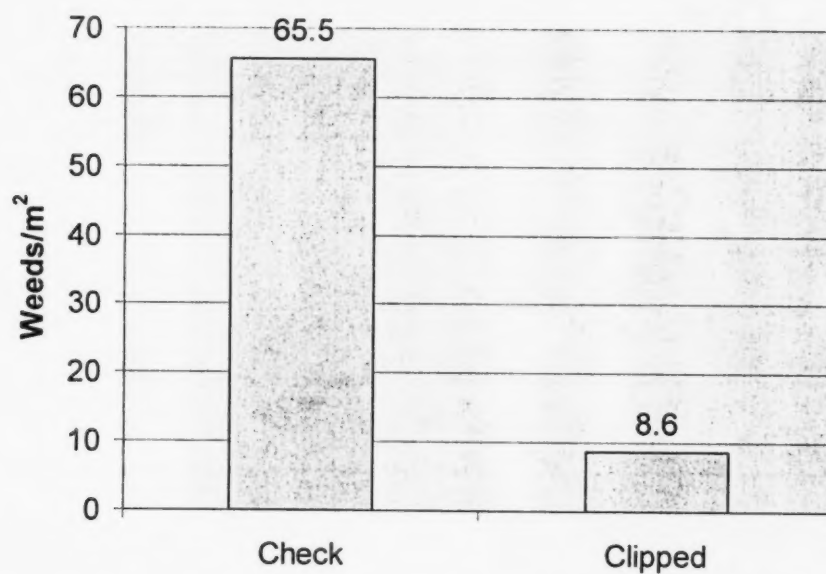


Figure 37. Effect of Weed Clipping on Weed Population 2001 – Site #3.

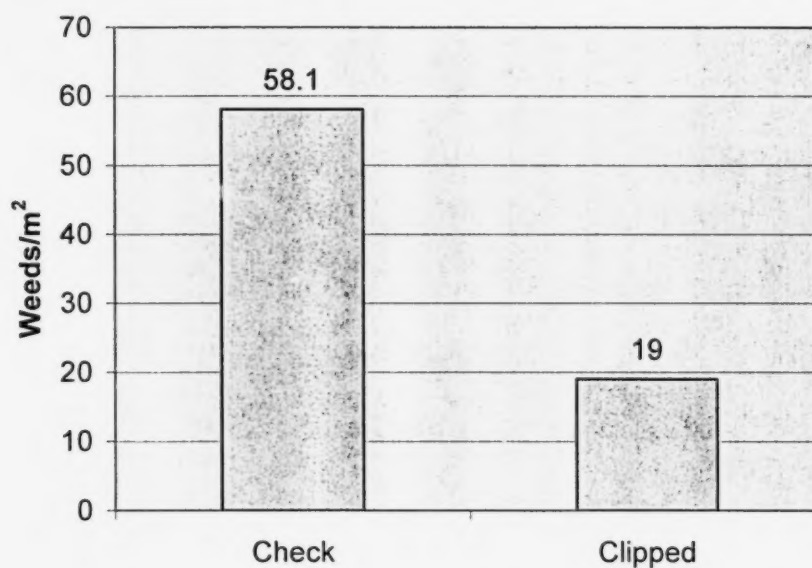


Figure 38. Effect of Weed Clipping on Weed Population 2001 – Site #5.

Table 1. Effect of Weed Clipping on Grain Yield 2001.

Site	Treatment	Crop	Gross Wt (kg)	Clean Wt (kg)	Dockage (%)	Yield (kg/ha)	Yield (bu/ac)
1	Check	Barley	7.12	6.00	18.7	807	15.0
1	Clipped	Barley	8.80	7.74	13.7	1041	19.4
2	Check	Oat	5.02	4.78	5.0	663	12.3
2	Clipped	Oat	4.92	4.72	4.2	655	12.2
3	Check	Oat	3.54	3.38	4.7	455	8.5
3	Clipped	Oat	2.44	2.32	5.2	312	5.8
5	Check	Oat	5.62	5.24	7.3	705	13.1
5	Clipped	Oat	11.70	10.96	6.8	1475	27.4

Weights in Kg per plot
 Harvest Area is 4 ft x 200 ft except for site #2 - site 32 is 4 ft x 194 ft
 Dockage is on a clean weight basis

4.2.4 Year 4 - 2002

In spring, very cold temperatures and dry weather prevented normal weed germination and emergence resulting in very low weed counts on May 18, 2002 (Figures 39 to 42).

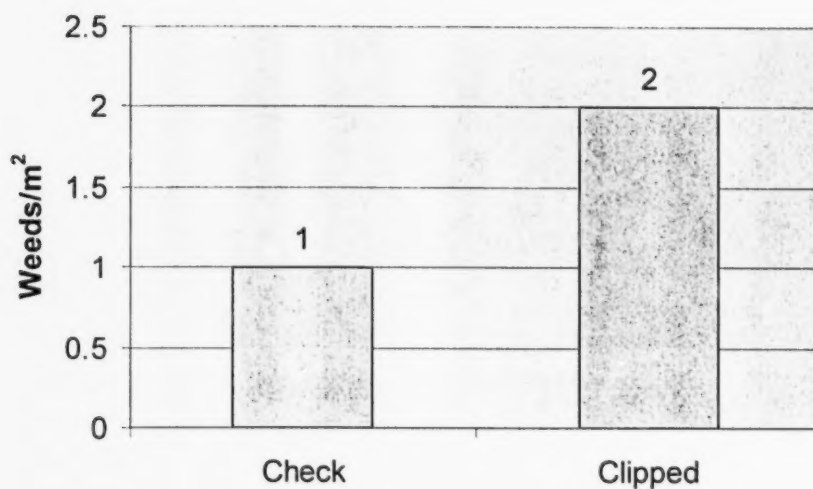


Figure 39. Effect of Weed Clipping on Weed Population May 18, 2002 – Site#1.

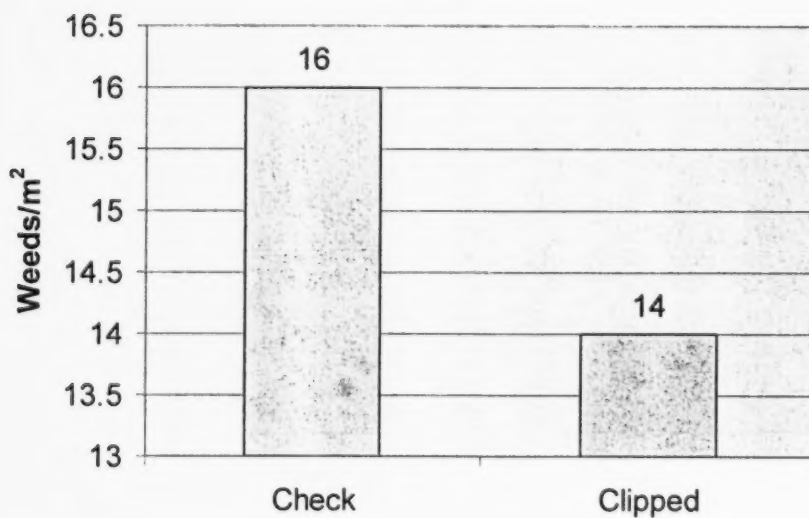


Figure 40. Effect of Weed Clipping on Weed Population May 18, 2002 – Site #2.

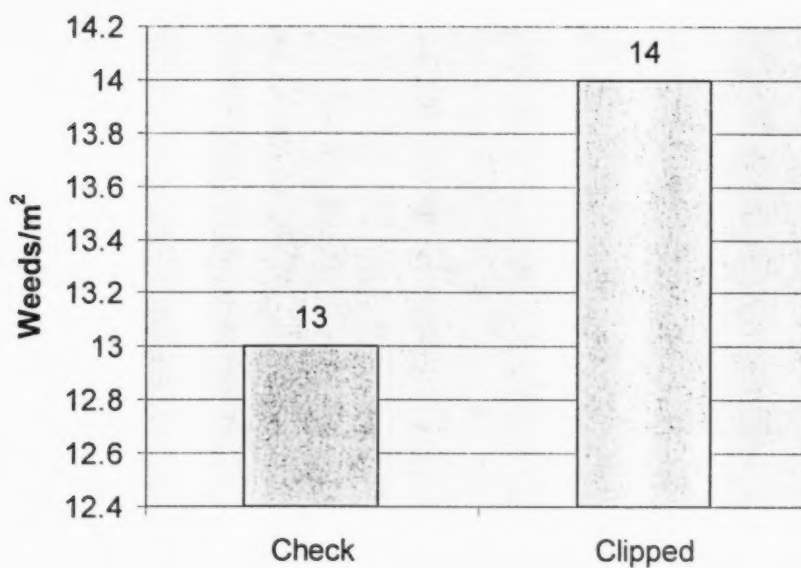


Figure 41. Effect of Weed Clipping on Weed Population May 18, 2002 – Site #3.

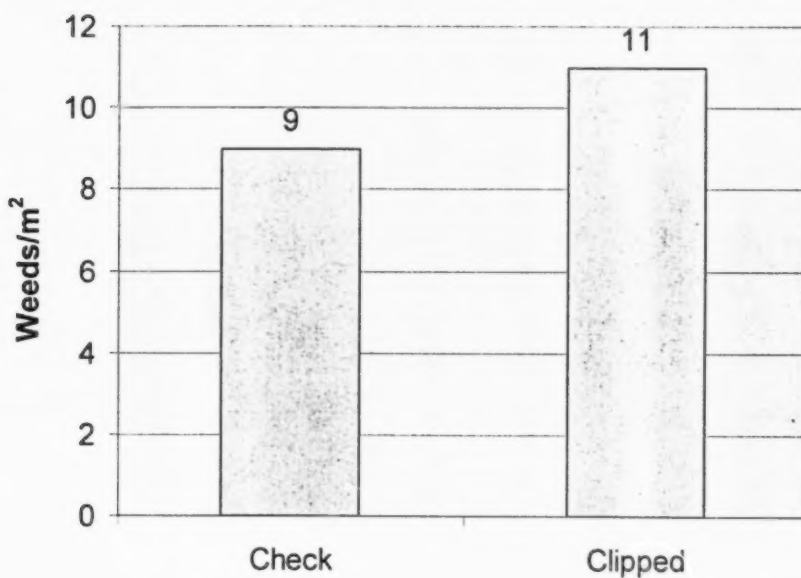


Figure 42. Effect of Weed Clipping on Weed Population May 18, 2002 – Site #5.

As there were too few weeds to compare the clipped and check treatments, the counts were repeated in crop on June 21, 2002 (**Figures 43 to 46**).

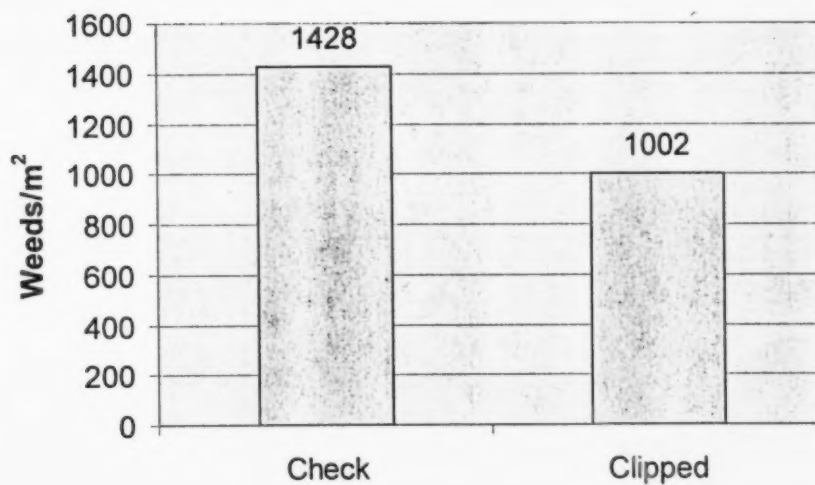


Figure 43. Effect of Weed Clipping on Weed Population June 21, 2002 – Site #1.

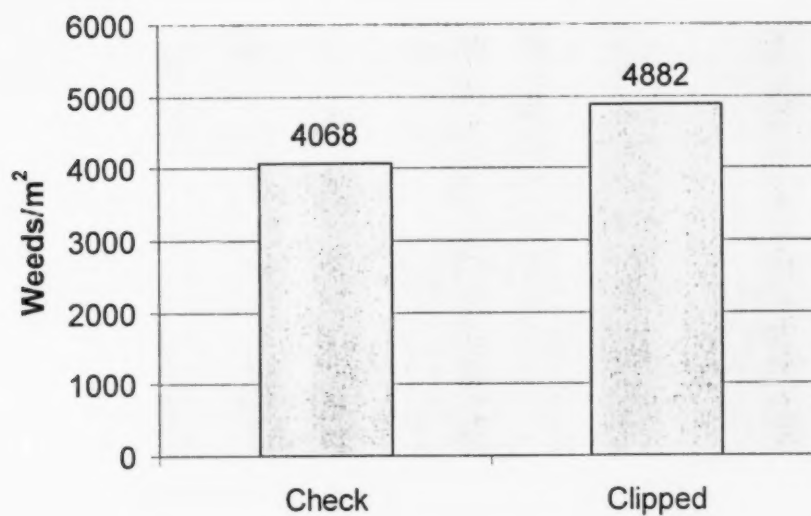


Figure 44. Effect of Weed Clipping on Weed Population June 21, 2002 – Site #2.

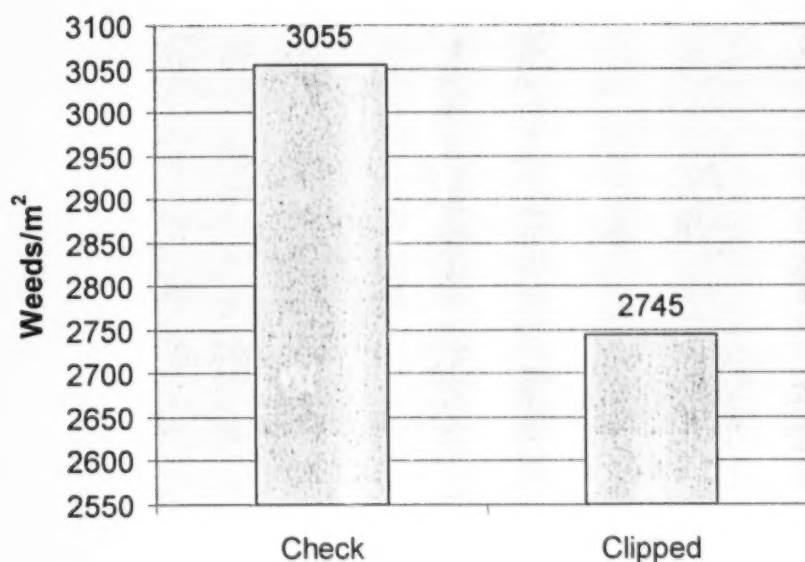


Figure 45. Effect of Weed Clipping on Weed Population June 21, 2002 – Site #3.

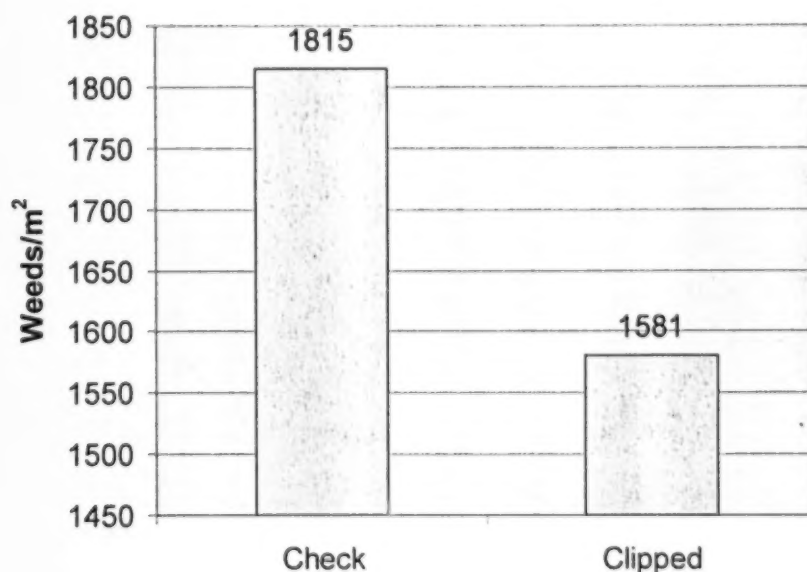


Figure 46. Effect of Weed Clipping on Weed Population June 21, 2002 – Site #5.

The extremely high weed counts taken on June 21, 2002, were due to delayed weed emergence prior to seeding. Delayed seeding in organic farming normally allows for mechanical weed control and is effective in most years. However, in Spring 2002, cold conditions prevented weed growth, resulting in huge numbers of weeds/m² and severe weed competition later in the year. Severe drought conditions along with weed competition resulted in near crop failure in 2002 (**Table 2**).

Table 2. Effect of Weed Clipping on Grain Yield, 2002.

Site	Treatment	Crop	Gross Wt (kg)	Clean Wt (kg)	Dockage (%)	Yield (kg/ha)	Yield (bu/ac)	Yield (lb/ac)
1	Check	Wheat	3.32	2.08	59.6	280	5.2	
1	Clipped	Wheat	4.08	2.72	50.0	366	6.8	
2	Check	Wheat	1.12	0.76	47.4	102	2.0	
2	Clipped	Wheat	1.38	1.14	21.1	153	2.9	
3	Check	Wheat	1.94	1.38	40.6	186	3.5	
3	Clipped	Wheat	2.44	1.70	1.3	229	4.3	
5	Check	Lentil	3.04	1.46	108.2	196		175.4
5	Clipped	Lentil	3.26	1.62	101.2	218		194.6

Weights in Kg per plot
Harvest Area is 4 ft x 200 ft except for site #2 - site 32 is 4 ft x 194 ft
Dockage is on a clean weight basis

4.3 Scott Project

Weed clipping did not result in a detectable lentil yield increase in either year (**Figure 47**). A more powerful experiment with more replications may have been able to detect a small yield difference. However, clipping must be postponed until the weeds elongate above the crop canopy. Most of the yield loss associated with weed competition occurs in early stages of crop development.

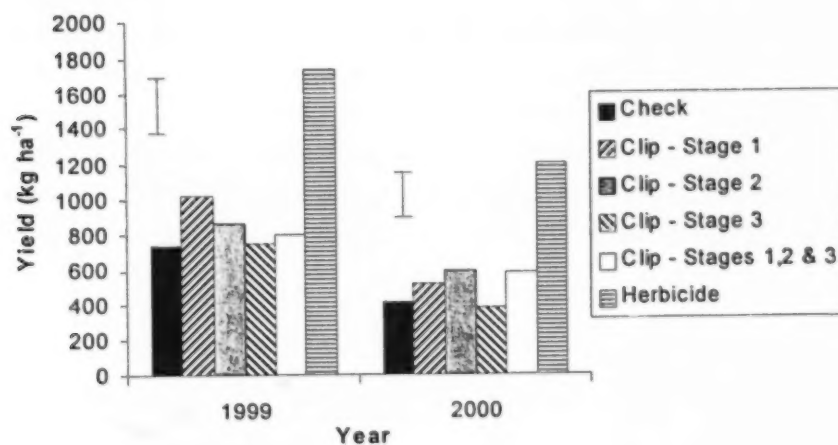


Figure 47. Effect of Weed Clipping on Yield of Lentil (kg ha⁻¹). Scott 1999-2000. Error Bars Represent the LSD0.05 within Years.

Although variable, clipping reduced subsequent weed seedling emergence. Clipping in 1999 reduced wild oat emergence the following spring if the clipping was done after wild oat heading (**Figure 48**). In the 2000-2001 study, low populations of wild oat were present and clipping did not cause a significant reduction in weed emergence.

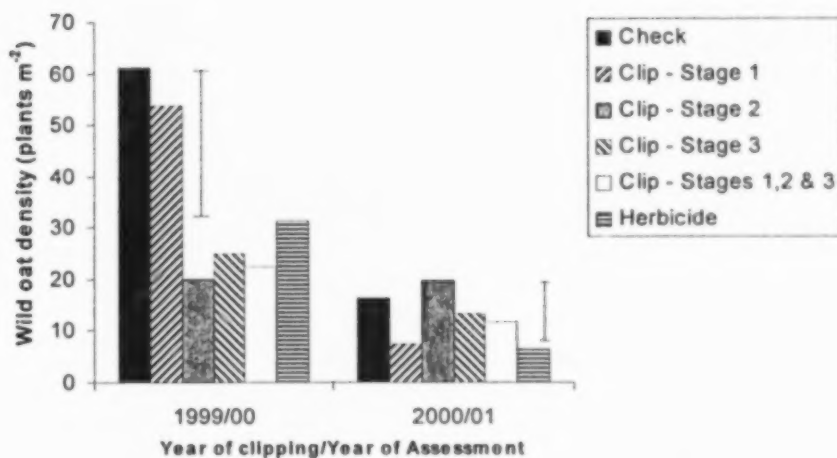


Figure 48. Effect of Weed Clipping on Subsequent Wild Oat Density (plants m⁻²). Scott 1999-2000. Error Bars Represent the LSD0.05 Within Years.

There was no detectable difference in wild mustard recruitment in the 1999-2000 study; however, there was a trend towards lower densities when the wild mustard was clipped at the podding stage (Figure 49). Many of the pods formed below the crop canopy in the first year of the study, which reduced the efficacy of clipping. Clipping at any weed stage was effective in reducing wild mustard recruitment in the 2000-2001 study (Figure 49). The differences between years may have been due to differences in the crop stands. The stand in the 2000-2001 study was much denser than the 1999-2000 study due to better growing conditions. It is hypothesized that the denser crop stand caused a higher percentage of the podding to occur above the crop canopy.

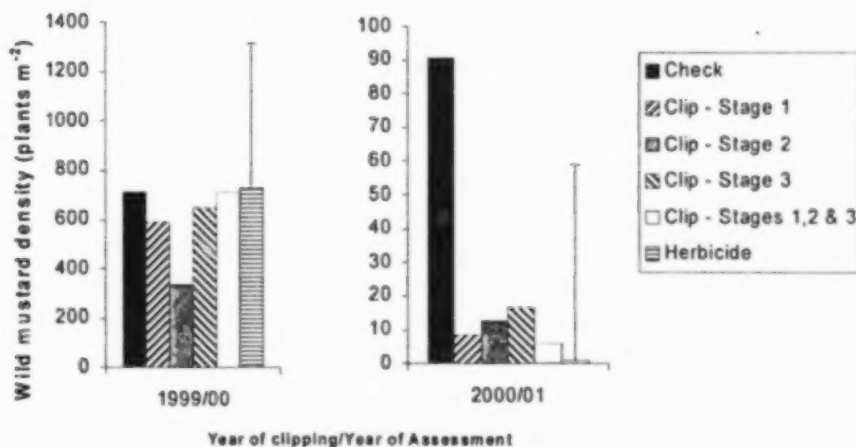


Figure 49. Effect of Weed Clipping on Subsequent Wild Mustard Density (plants m⁻²). Scott 1999-2000. Error Bars Represent the LSD0.05 Within Years.

Recruitment of lambs quarters in 2000-01 was significantly reduced by weed clipping at all stages (Figure 50). Lambs quarters was not present in the 1999-2000 study.

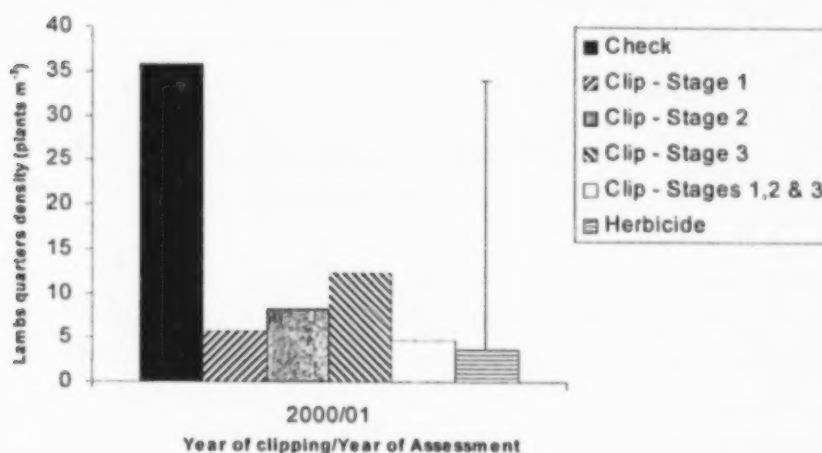


Figure 50. Effect of Weed Clipping on Subsequent Lambs Quarters Density (plants m⁻²). Scott 1999-2000. Error Bars Represent the LSD0.05 Within Years.

In some cases, the weeds resumed growth quite quickly after clipping and the seed was able to develop. However, the lack of a timing effect in the 2000/2001 experiment suggests that the clipping may have affected weed seed viability by delaying seed development. Further research should be conducted to test this hypothesis.

5. Conclusions

Modifications to a self-propelled swather and a farmer-designed flail system were both very successful in removing a high percentage of above crop weed seed heads and flowers in both years of the study.

Clipping weed seed heads and flowers was successful in reducing weed populations in the year following clipping at both Scott and Spalding.

The effect of weed clipping on crop yield in the year of clipping was mixed with no significant effect on grain yield at Scott and an average 7.6% yield increase compared to the check at Spalding. Yield effects in 2001, the year after clipping, were mixed at Spalding with higher yields for clipped treatments at two sites and lower or equal yields at two sites. Yield data from 2002 was not useful due to extreme drought.

9. Project Public Information Materials

The results from this project were presented at seminars in the form of a poster and to many producers at extension events. The results have also been used in mechanical weed control lectures for weed science classes at the University of Saskatchewan.

Activities:

When	Where	# people in attendance
Activities: Nov. 27, 2002	Canadian Weed Science Society Annual Meeting – Physical Weed Control Working Group.	45
Nov. 7, 2002	Guest Lecture – Weed Ecology Course Mechanical Weed Control – Part II	45
July 23, 2002	Organic Producer Field Tour - Scott	5
March 26, 2002	Organic Producer Group Meeting – Kerrobert. Topic – Organic Crop Production Research at the Scott Research Farm	10
March 11, 2002	Growing Organic Conference – Red Deer, AB. Organizer – AAFRD. Topic – Mechanical Weed Control in Organic Systems.	300
Feb. 12, 2002	Lecture at University of Saskatchewan. School of Agriculture Weeds Class. Topic: Mechanical Weed Control.	20
Feb. 8, 2002	SAF Organic Meeting – Melfort. Topic: Organic Research at Scott	60
Feb. 7, 2002	SAF Organic Meeting – Yorkton. Topic: Organic Research at Scott	100
Nov. 22, 2001	University of Saskatchewan –Guest Lecture – Weed Ecology Course Mechanical Weed Control – Part II	100
Feb. 15, 2001	Organic Production Meeting - Yorkton	125
Jan. 17, 2001	Update on Weed Control Research for SAF Extension staff – Saskatoon	35
July 24, 1999	Tour Marysburg Plots	60
Total		905

Special publications/ Conference and workshop proceedings

Johnson, E.N. and G.E. Hultgreen. 2002. Clipping weeds above crop canopy reduces seedling recruitment the following year. *In Proc. Western Society of Weed Science Annual Meeting*. Salt Lake City, UT. March 11-14, 2002.

Johnson, E.N. and G.E. Hultgreen. 2002. Clipping weeds above crop canopy reduces seedling recruitment the following year. *In Proc. Soils and Crops Workshop 2002*. Extension Division, University of Saskatchewan, Saskatoon, SK.

